Course guide
33107 - RE - Energy Resources

Last modified: 29/05/2024

Unit in charge: Manresa School of Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.
750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: MASTER'S DEGREE IN NATURAL RESOURCE ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2024 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: JORDI CUNILL SOLA

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:
1. Awareness of environmental issues.

TEACHING METHODOLOGY

Lectures on theory and problems. The professor develops the topics and emphasises key concepts and those that are most frequently misunderstood. Efforts are made to pose questions that stimulate students' participation and answer any questions that arise. Typical problems are put forward and solved step by step, with an emphasis on areas in which mistakes are most often made. In the virtual campus, students have access to lecture notes and the problems posed in each topic and its numerical result; in this way, independent learning is encouraged.
·Resolution and delivery of proposed works, exercises and / or problems.
·Continuous assessment and written tests on theory and problems.

LEARNING OBJECTIVES OF THE SUBJECT

On completion of the subject, students must be able to:
·Discern types of renewable energy sources.
·Apply the theory to renewable energy generation systems and the interaction with electric power systems.
·Handle laboratory instruments, collect data correctly, process these data and draw up a report

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	66.67
Hours medium group	15,0	33.33

Total learning time: 45 h

CONTENTS

: ELECTRIC POWER SYSTEMS: GENERATION, TRANSMISSION AND DISTRIBUTION OF ELECTRICAL ENERGY

Description:
Introduction. Electric power systems.
· Historical evolution of electricity and electrical systems.
· The electrical grid. Voltage levels.
· Classification of power plants. Renewable and non-renewable energies.
· Introduction to types of power plants.
· Environmental impact of the production of electrical energy.
· Electricity demand curve. Planning generation.
· Parameters of demand and production.

Full-or-part-time: 8h
Theory classes: 8h

HYDRAULIC ENERGY. HYDROELECTRIC GENERATION

Description:
Introduction. Definition and basic operation.
· Classification of hydroelectric power plants.
· Elements of a hydroelectric power plant.
· Typical configurations. Types of dams.
· Hydroelectric turbines: Francis, Pelton, Kaplan and others. Selection criteria.
· Hydraulic aspects: cavitation and water hammer.
· Reversible and pumped-storage plants.
· Advantages and disadvantages.

Full-or-part-time: 17h
Theory classes: 17h

SOLAR POWER. GENERALITIES AND PHOTOVOLTAIC SYSTEMS

Description:
Introduction. Energy and environmental impact.
· Renewable energies and sustainable development.
· Solar power: the Sun, radiation, peak sun hour. Classification of thermal and photovoltaic solar power systems.
· Photovoltaic systems: PV cells. Current–voltage curves. Equations and equivalent circuit. Cell technologies and performance. Solar panels. Elements and electrical characteristics. Connection of panels and solar tracking.
· Photovoltaic installations. Isolated installations. Basic diagrams. Hybrid systems. Installations connected to the grid. PV power stations.
· Advantages and disadvantages of PV systems.

Full-or-part-time: 15h
Theory classes: 15h

OTHER RENEWABLE SOURCES OF ENERGY

Description:
Introduction to wind energy. Wind turbines.
· Onshore and offshore wind farms.
· Tidal power.
· Environmental impact of renewable energies.
· Other emerging sources of energy.

Full-or-part-time: 5h
Theory classes: 5h

ACTIVITIES

PRACTICAL ACTIVITY PLAN

Description:
Library and Internet research assignment on Spain's electrical grid and its management. Daily electricity demand curves and their coverage with renewable and non-renewable energy are studied in detail. Each student will collect data from different months and years and submit the work individually. The assignment can be presented orally with PowerPoint slides.

·Laboratory practical. Once they have been given the instructions by the professor, students must assemble the circuits and the measuring devices that are appropriate to each case in order to experiment and verify the theoretical and practical concepts that they have studied beforehand. Content of the practical: Photovoltaic solar power. Description and study of solar panels and their components.

·Laboratory practical. Content of the practical: Connection and start-up of an entire isolated photovoltaic solar power installation.

Full-or-part-time: 67h 30m
Self study: 67h 30m

GRADING SYSTEM

Mid-semester and final exams on theory and problems.
·The second and final exams take place on the same day on the date set by the head of studies.
·Problems, practicals and individual assignments (Nppt).
·Final mark: NF
NF = 0.30 N1A + 0.40 N2A + 0.30 Nppt NF = 0.70 NAF + 0.30 Nppt

EXAMINATION RULES.

Students must follow the instructions and meet the deadlines given in the virtual campus.
·The reports on the practicals and the assignments, exercises and/or problems must be handed in by the deadline. Handing in after a deadline lowers a student's mark and may even mean that the assignment is not accepted.
·An A4 sheet of paper is only made available in the problem-solving section of exams.

BIBLIOGRAPHY

Basic:
- Quaschning, V. Understanding renewable energy systems [on line]. London: Earthscan, 2005 [Consultation: 13/06/2022]. Available on: https://www-taylorfrancis-com.recursos.biblioteca.upc.edu/books/mono/10.4324/9781315769431/understanding-renewable-energy-systems-volker-quaschning. ISBN 1844071286.

Complementary:
- Rodríguez, J. L.; Arnalte, S.; Burgos, J. C., coords. Sistemas eólicos de producción de energía eléctrica. Alcorcón: Rueda, 2003. ISBN 8472071391.
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- Hernández Gonzálvez, Cayetano, i altres. Minicentrales hidroeléctricas [on line]. Madrid: Instituto para la Diversificación y Ahorro de la Energía, 1996 [Consultation: 21/12/2020]. Available on: http://dl.idae.es/Publicaciones/10374_Minicentrales_hidroelectricas_A2006.pdf.
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- Unidad Eléctrica, S.A.. Centrales eléctricas. Madrid: UNESA, 1998.